

# Abstract

## A study on gamma-spectrometric measurement for naturally occurring radioactive material(NORM)

- Based on Radon -

Eun-Kyo Chung, Kab-Bae Kim

*Occupational Environment Research Department,  
Occupational Safety and Health Research Institute, KOSHA*

### 1. Objectives

We constructed the analysis system for measurement of the activity concentration of the radioactive material and evaluation of the effective dose due to radon exposure. In order to improve the utilization of by gamma spectrometry was reviewed methods of measurement and analysis of the international standard, ISO (International Organization for Standardization).

This provided for an analysis procedure and evaluated by applying this analysis method using the phosphate rocks, phosphogypsum as a raw materials and process by-products containing NORM .

### 2. Methods

○ We wrote an analysis procedures for the precise analysis of the activity concentration of the radioactive material, such as radon and radon daughters.

○ The standard sample (Ra-226) radionuclides in a single standard were produced in Korea Research Institute of Standards and Science(KRISS). The measurement samples were weighed and were allowed to reach equilibrium radiation for one month. Samples were analyzed by HPGe(highly pure germanium) gamma spectroscopy.

### 3. Results

○ It was created a quantitative procedure using gamma spectroscopy for analyzing the radioactivity concentration of the raw materials or process by-products such as phosphate rocks and phosphogypsum contained NORM(Ra-226, etc.).

○ The geometric mean concentration of radon in the phosphate rock and phosphogypsum samples at a fertilizer manufacturer were 522.7 Bq/m<sup>3</sup> (GSD 1.19), 346.9 Bq/m<sup>3</sup> (GSD 1.06), respectively.

○ The geometric mean concentration of radon in the desulfurization gypsum at gypsum-board manufacturers were 66.5 Bq/m<sup>3</sup> (GSD 1.54).

○ The geometric mean concentration of radon in the sample of phosphate and desulfurization gypsum at cement manufacturers were 236.9 Bq/m<sup>3</sup> (GSD 1.16), 133.0 Bq/m<sup>3</sup> (GSD 1.0), respectively.

○ Activity exhalation rate of radon by placing alpha-tracks directly on gypsum-board or in grooves dug from gypsum-board which is commercially available were ND~0.261 pCi/m<sup>2</sup>·hr or ND~0.347 pCi/m<sup>2</sup>·hr, respectively.

### 4. Conclusion

The raw materials and process by-products containing NORM such as phosphate rocks and phosphogypsum can cause serious environmental and

radiological problems. There are a beneficial uses in road construction, building materials and other applications. But the usage, handling radioactive materials may lead to increased radiation doses to workers and public members. There are necessary to reduce radiation exposure from NORM. Also, an additional surveys are needed for zirconium, bauxite and moissanite.

**Keywords;** NORM, Radon, ISO, Activity concentration, Activity exhalation rate